LOUISIANA DEPARTMENT
OF WILDLIFE & FISHERIES

OFFICE OF FISHERIES
INLAND FISHERIES SECTION

PART VI -B

WATERBODY MANAGEMENT PLAN SERIES

HENDERSON LAKE

WATERBODY EVALUATION & RECOMMENDATIONS

CHRONOLOGY

DOCUMENT SCHEDULED TO BE UPDATED ANNUALLY

May 2007 - Prepared by
Jody T. David, Biologist Manager, District 6

January 2012 – Vegetation recommendations updated by
Mike Walker, Biologist Manager, District 9

February 2014 - Updated by
Brac Salyers, Biologist Manager, District 9

August 2014 – Updated by
Brac Salyers, Biologist Manager, District 9

August 2015 – Updated by
Brac Salyers, Biologist Manager, District 9

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WATERBODY EVALUATION

STRATEGY STATEMENT

Recreational
Black bass, crappie, and catfish in Henderson Lake are managed to provide anglers the greatest opportunity to catch and harvest a limit of fish. Sunfish are managed to provide a sustainable population while providing anglers the opportunity to catch and harvest numbers of fish.

Commercial
Commercial species of fish are managed to provide a sustainable population.

Species of Special Concern
No threatened or endangered fish species have been documented in this waterbody.

EXISTING HARVEST REGULATIONS

Recreational
The Louisiana Wildlife and Fisheries Commission amended a rule to repeal the 14 inch minimum length limit (MLL) on black bass in the Atchafalaya Basin and adjacent waters. Effective June 20, 2013, the new regulations were a 7 fish daily creel limit with no MLL. This regulation was in effect for two years. In June 2015, the regulation expired, and the area reverted to the statewide regulation of 10 black bass with no MLL.

Black Bass – no minimum length limit, 10 fish daily bag limit.

Statewide regulations for all fish species except black bass may be viewed at the link below:
http://www.wlf.louisiana.gov/fishing/regulations

Commercial
The commercial fishing regulations may be viewed at the link below:
http://www.wlf.louisiana.gov/fishing/regulations

SPECIES EVALUATION

Recreational
Electrofishing is the most commonly used sampling technique to assess largemouth bass (LMB) relative abundance (catch per unit effort = CPUE), size distribution, and relative weight (physical body condition). Data collected during fall electrofishing is used to describe population trends, age composition, growth rate and mortality rate. The water in Henderson Lake is typically under influence from the Atchafalaya River in the springtime. High, turbid waters are an inconsistent influence to sampling. For that reason, electrofishing sampling is conducted in the fall only.

Largemouth Bass

Relative abundance, size structure indices, and length distribution

Electrofishing catch per unit effort (CPUE) fluctuated significantly from 1988 through 1997 (Figure 1). The total catch rates for 1988 and 1989 were below 50 LMB per hour, while the average for 1992 and 1993 were over 150 an hour. The numbers declined again over the next two years and sharply increased the following two years. Results depicted in Figure 2 show LMB catch rates to be highly variable. In relation to total CPUE, catch rates of individual size classes provide a more detailed description of the variations.

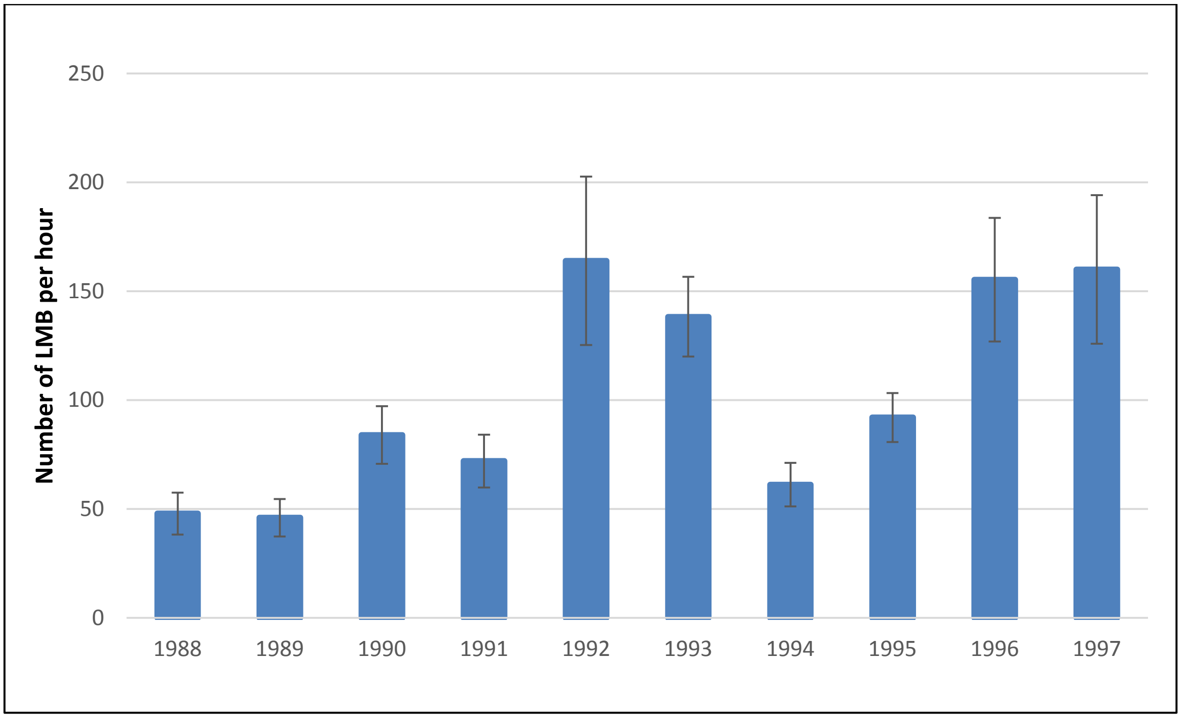

Figure 1. The mean total CPUE (± SE) for largemouth bass collected from Henderson Lake, LA during fall electrofishing (1988-1997).

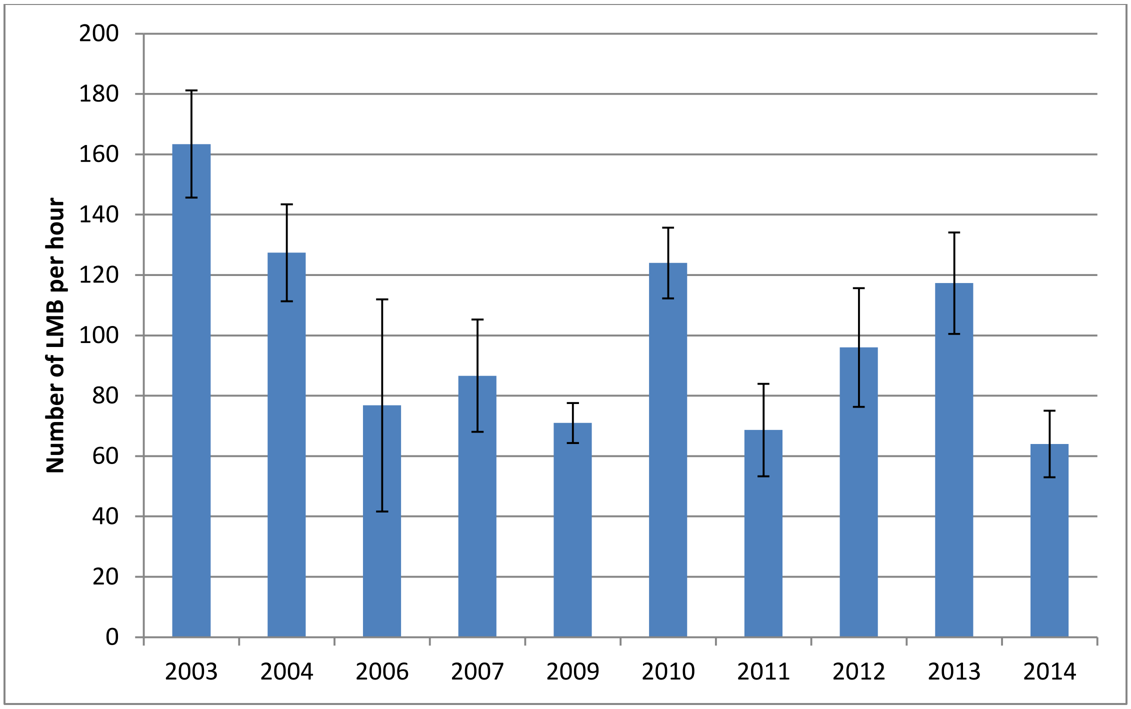

Figure 2. The mean total CPUE (+ SE) for largemouth bass collected from Henderson Lake, LA during fall electrofishing (2003-2014).

Catch indices in Figure 3 clearly show a sharp peak in reproduction (substock-size) in 1993 following Hurricane Andrew. Stock-size bass continued to increase with each successive year. The discovery of hydrilla in 1994 is associated with an upward trend of bass. In Figure 4, a strong sub-stock size class can be seen in 2003 subsequent to Hurricane Lili related fish kills. Lower catch rates for ’06, ’07, and ’09 are likely related to the series of fish kills resulting from Hurricanes Rita (2005) and Gustav and Ike (2008). The increased abundance observed in the 2010 sample reflects natural recovery from storm related fish kills.

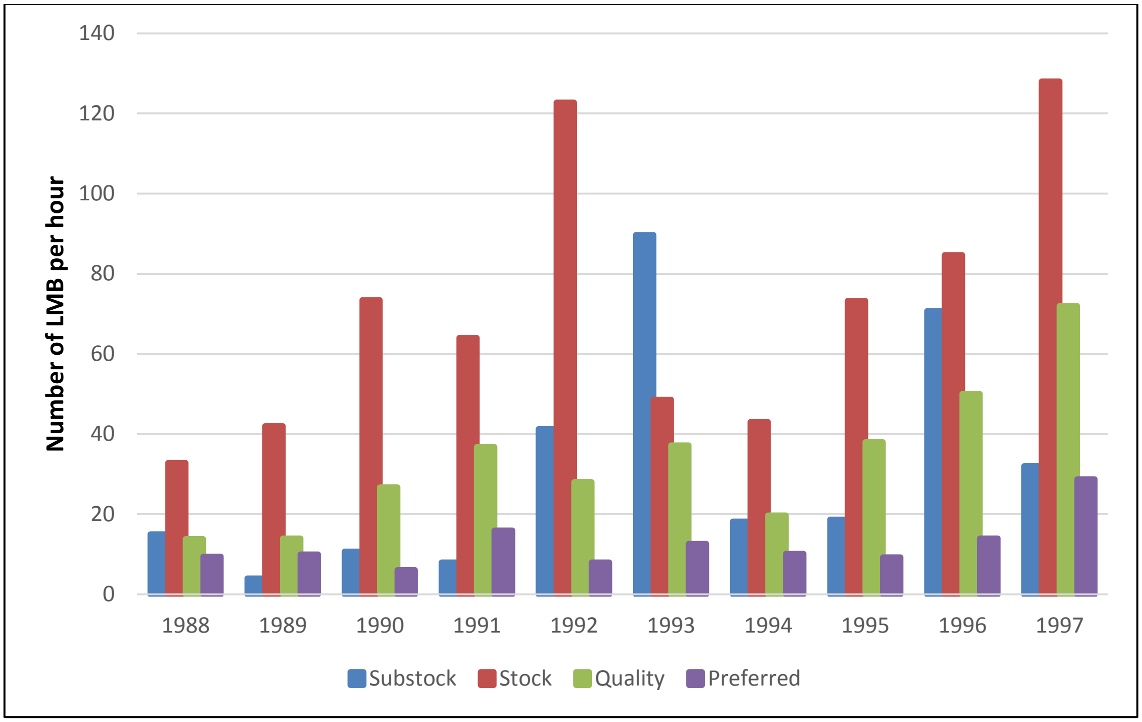

Figure 3. The CPUE for sub-stock, stock, quality and preferred size largemouth bass collected from Henderson Lake, LA during fall electrofishing (1988-1997).

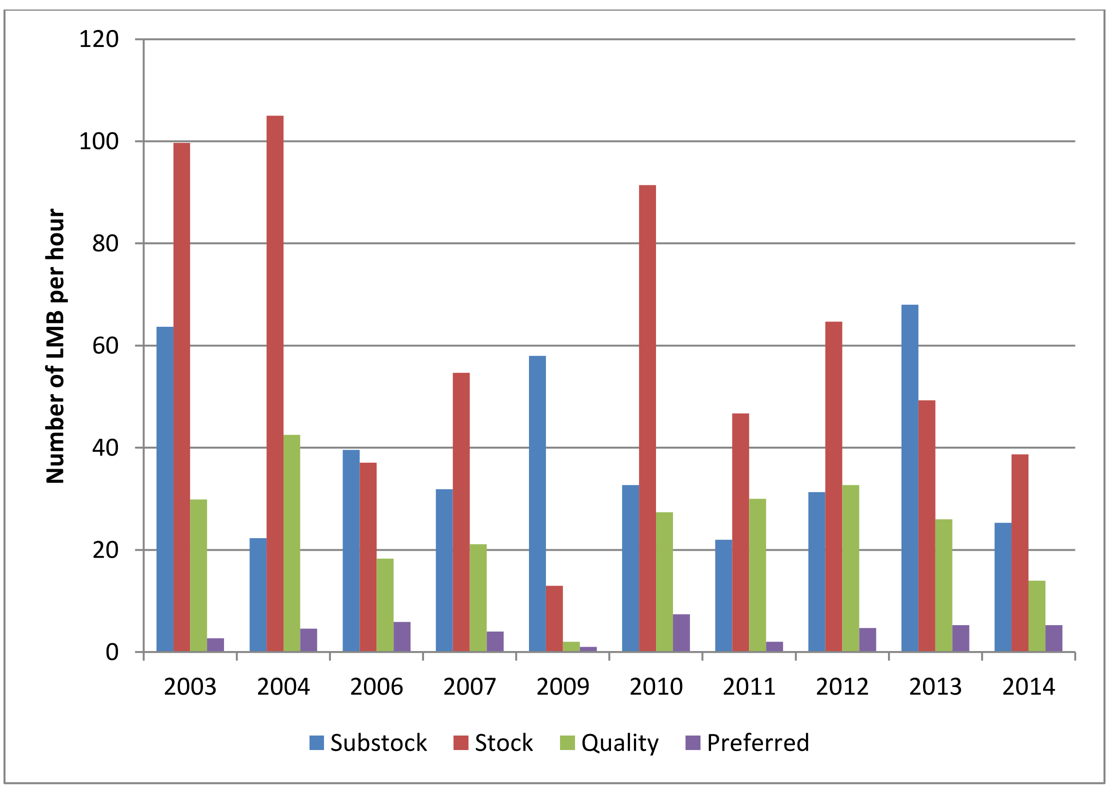

Figure 4. The CPUE for sub-stock, stock, quality and preferred size largemouth bass collected from Henderson Lake, LA during fall electrofishing (2003-2014).

Results from 2014 sampling represent current largemouth bass size distribution for Henderson Lake (Figure 5). Young-of-the-year (YOY) bass (3 to 6 inches) represent 31% of the sample. Stock and quality-size bass (8 to 14 inches) represent 52% of the sample. Bass greater than 14 inches represent only 8% of the sample.

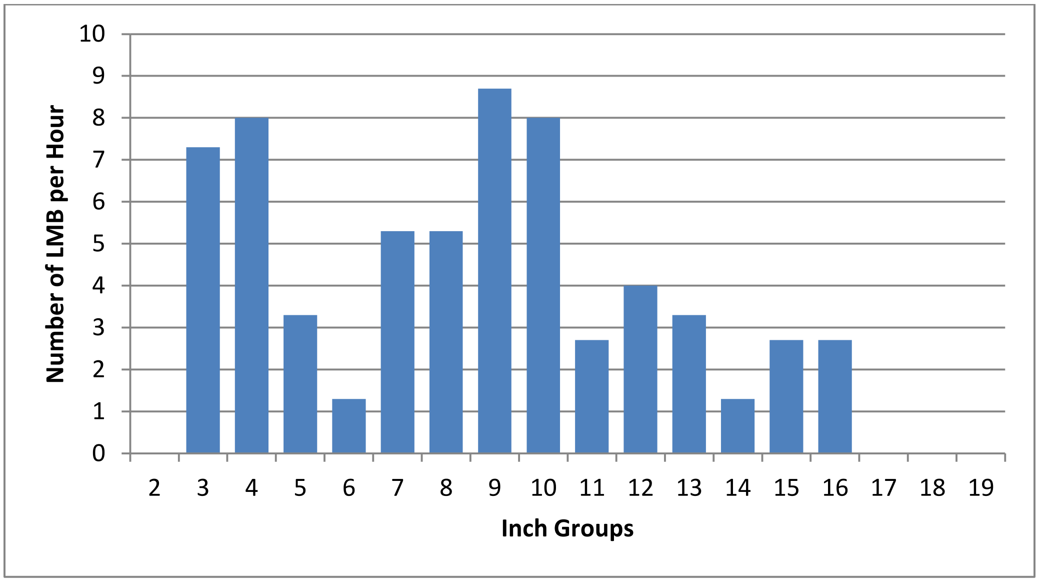

Figure 5. Size distribution (inch groups) of largemouth bass collected during one hour of electrofishing effort at Henderson Lake, LA in fall 2014 (n=96).

Proportional stock density (PSD) and relative stock density (RSD) are indices used to numerically describe length-frequency data (Anderson and Neumann 1996). Proportional stock density compares the number of fish of quality size (> 12 inches for largemouth bass) to the number of bass of stock size (> 8 inches in length), and is calculated by the formula:

$$\text{PSD} = \frac{\text{Number of bass} \geq 12 \text{ inches}}{\text{Number of bass} \geq 8 \text{ inches}} \quad \text{X } 100$$

PSD is expressed as a percentage. A fish population with a high PSD consists mainly of larger individuals, whereas a population with a low PSD consists mainly of smaller fish. A value between 40 and 70 generally indicates a balanced bass population.

Relative stock density (preferred, RSD_{15}) is the percentage of largemouth bass in a stock (fish over 8 inches) that are also 15 inches TL or longer, and is calculated by the formula:

$$RSD_{15} = \frac{\text{Number of bass} \geq 15 \text{ inches}}{\text{Number of bass} \geq 8 \text{ inches}} \quad \text{X } 100$$

An RSD_{15} value between 10 and 40 indicates a balanced bass population, while values between 30 and 60 indicate a higher abundance of larger fish.

As seen in Figure 6, these 10 years of data show a viable bass population, with 7 of 10 years having favorable PSD values, and 8 of 10 years having favorable RSD_{15} values. The poorest stock density values (1992) reflect sampling conducted in the wake of Hurricane Andrew.

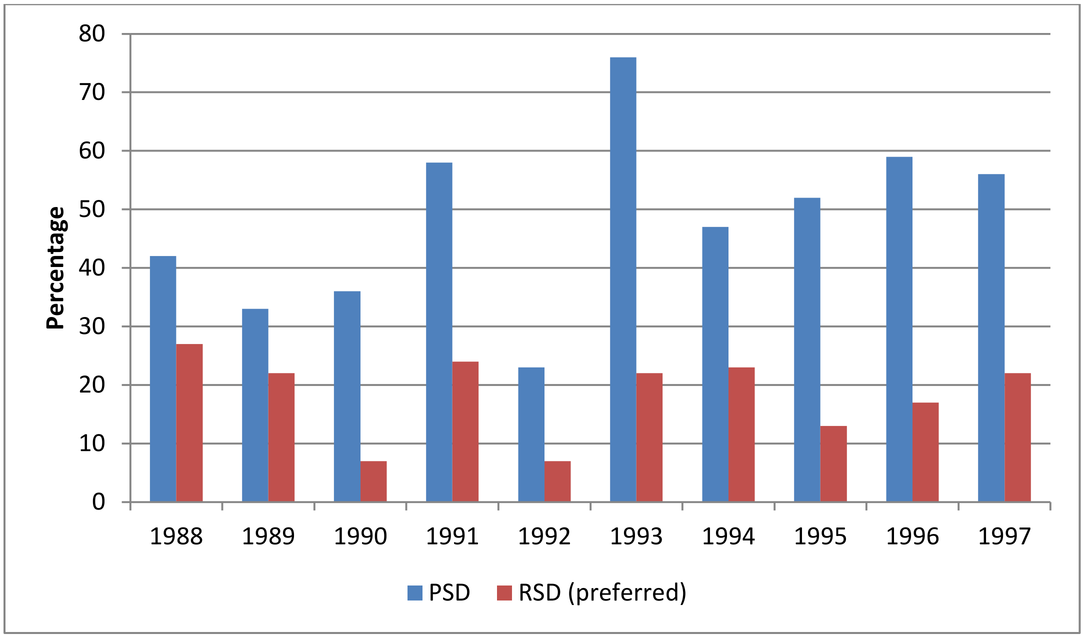

Figure 6. Proportional stock density (PSD) and relative stock density (RSD_{15}) for largemouth bass collected from Henderson Lake, LA during fall electrofishing (1988 – 1997).

The last 10 years of stock density data (Figure 7) indicate that the Henderson Lake bass population is lacking in abundance of bass larger than 15 inches. The influence of environmental conditions is undoubtedly a significant contributing factor. Events occurring within this time frame include 3 major hurricanes, 2 floods, and a year of very low water levels.

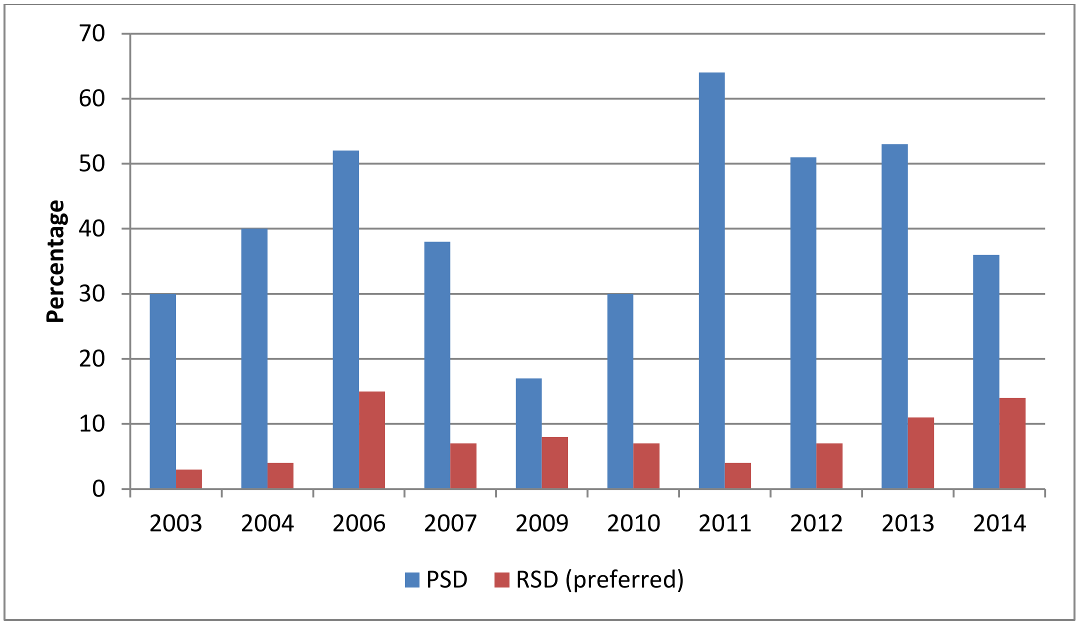

Figure 7. Proportional stock density (PSD) and relative stock density (RSD_{15}) for largemouth bass collected from Henderson Lake, LA during fall electrofishing (2003 – 2014).

<u>Relative weight</u>

Mean relative weight (Wr) for each inch group is shown below in Figure 8. This measurement is defined as the ratio of fish weight to the weight of a ‘‘standard’’ fish of the same length. The Wr index is calculated by dividing the weight of a fish by the standard weight for its length, and multiplying the quotient by 100. Largemouth bass relative weights below 80 may indicate a problem of insufficient or unavailable forage; whereas relative weights closer to 100 indicate that sufficient forage is available. A description of the forage species and relative abundance is described below. Mean relative weights for almost all size classes of largemouth bass from Henderson Lake are at or above the 95 value. Relative weights for 2012, 2013, and 2014 were all near the 100 value. The robust body condition of Henderson Lake bass is an indication that bass forage is abundant and available.

Figure 8. The mean relative weights by length category for largemouth bass collected from fall electrofishing (2003-2014; n=1,355).

Forage

Henderson Lake forage is primarily comprised of shad and sunfish. An average of three 1-acre rotenone samples/year is shown below. The results provide an indication that forage has not been a limiting factor in largemouth bass growth.

Table 1. Total weight (lbs.) of forage fishes collected from Henderson Lake, LA (1981-1998).

Year	Total lbs./acre — forage
1981	215.7
1985	1,835.2
1987	372.1
1990	131.5
1997	166.0
1998	224.4

Largemouth bass genetics

Genetic analyses of largemouth bass through electrophoresis of liver tissues show a range of 0 to 1% total Florida largemouth bass (FLMB) genome influence from the years 1999 and 2004 (Table 2). Florida largemouth bass were stocked annually from 2000 to 2006 at a rate of approximately 10 fish per acre. Despite the multiple stockings, genetic sampling conducted in 2004 indicates that only 9% of the Henderson Lake bass population carried genetic material characteristic of Florida bass. Such results may be disappointing in terms of providing genetic potential for large bass size but, they are not entirely negative. The failure of a larger Florida bass influence provides additional confirmation that the native bass population is particularly resilient, and that recruitment is strong.

Table 2. Genetic analysis of largemouth bass samples from Henderson Lake, LA (1999 and 2004).

Year	Northern	Florida	Hybrid	Florida Influence
1999	100%	0%	0%	0%
2004	91%	1%	8%	9%

Black Crappie

Relative abundance and size distribution-

As shown in Figure 9, fall electrofishing CPUE for black crappie on Henderson Lake showed consistently lower numbers from 1988 through 1992. Hurricane Andrew struck in August of 1992. Fish kills related to Hurricane Andrew were massive. Increased abundance of sub-stock size (YOY) crappie in 1993 is evidence of fish population recovery from those kills. Diminished predation allowed high survival of newly spawned fish. A similar increase is noted in 2003 following Hurricane Lili (Figure 10).

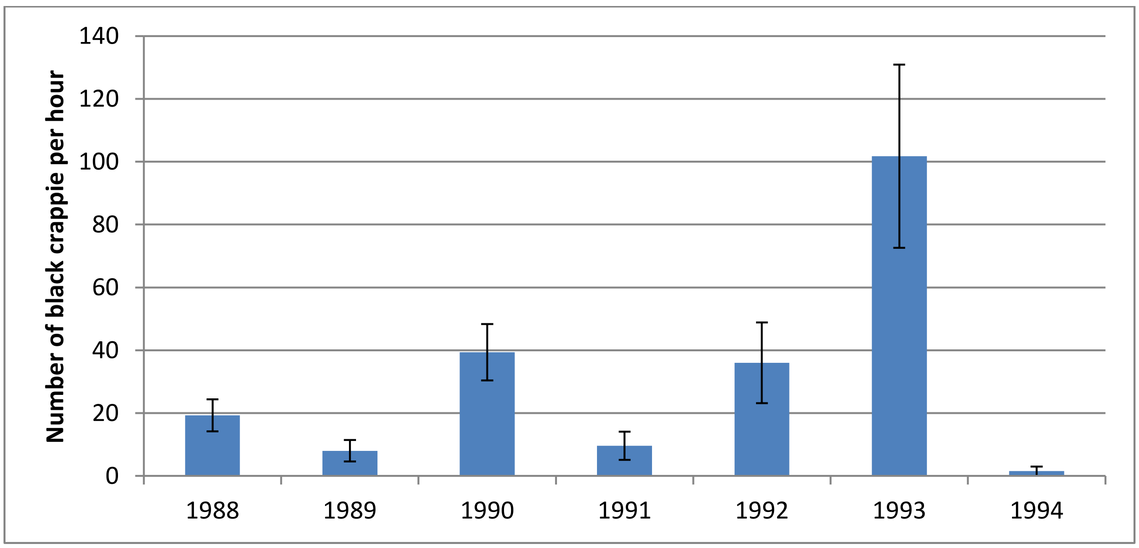

Figure 9. The mean total CPUE (± SE) for black crappie collected from Henderson Lake, LA during fall electrofishing (1988-1994).

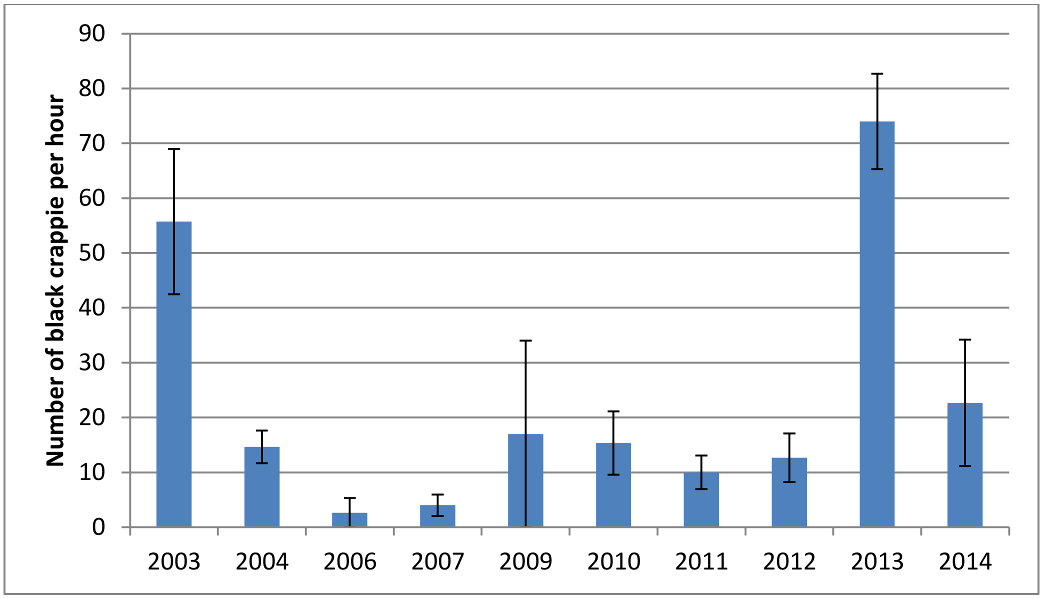

Figure 10. The mean total CPUE (+ SE) for black crappie collected from Henderson Lake, LA during fall electrofishing (2003-2014).

Black crappie catch indices show consistently lower catch rates from 1988-1992 with an increased number of stock-size crappie (5-8 inch) collected in 1990 (Figure 11). The large increase in sub-stock and stock size crappie in 1993 indicates recovery from Hurricane Andrew related fish kills. The sharp increase in crappie collected in 2003 shows that stock size fish (5-8 inch) were in relatively high abundance (Figure 12). The rise in sub-stock size fish in 2009 indicates recovery after Hurricane Gustav. That cohort can be followed into the next year (2010) with an increase in stock-size fish abundance.

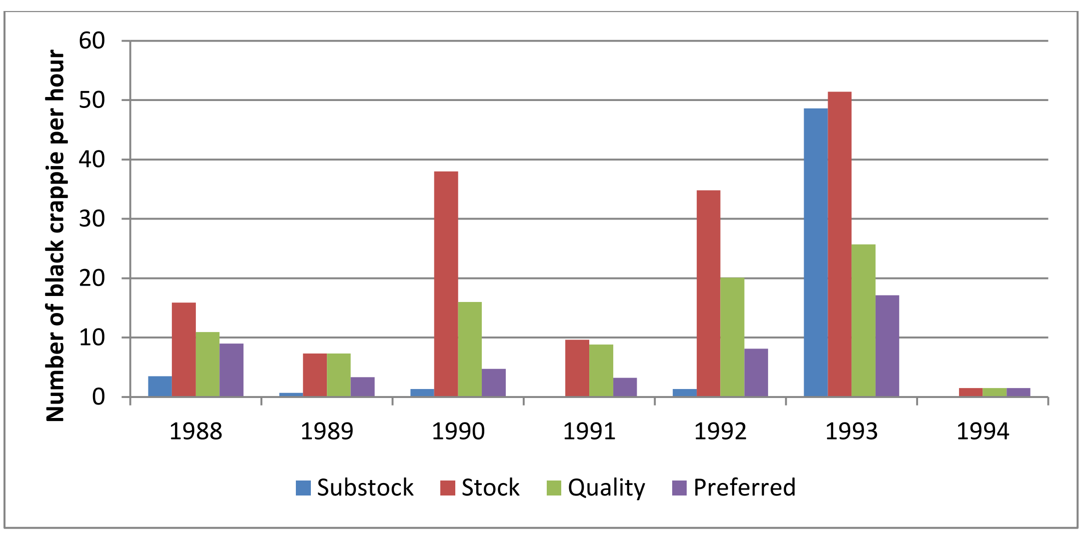

Figure 11. The CPUE for sub-stock, stock, quality, and preferred size black crappie collected from Henderson Lake, LA during fall electrofishing (1988-1994).

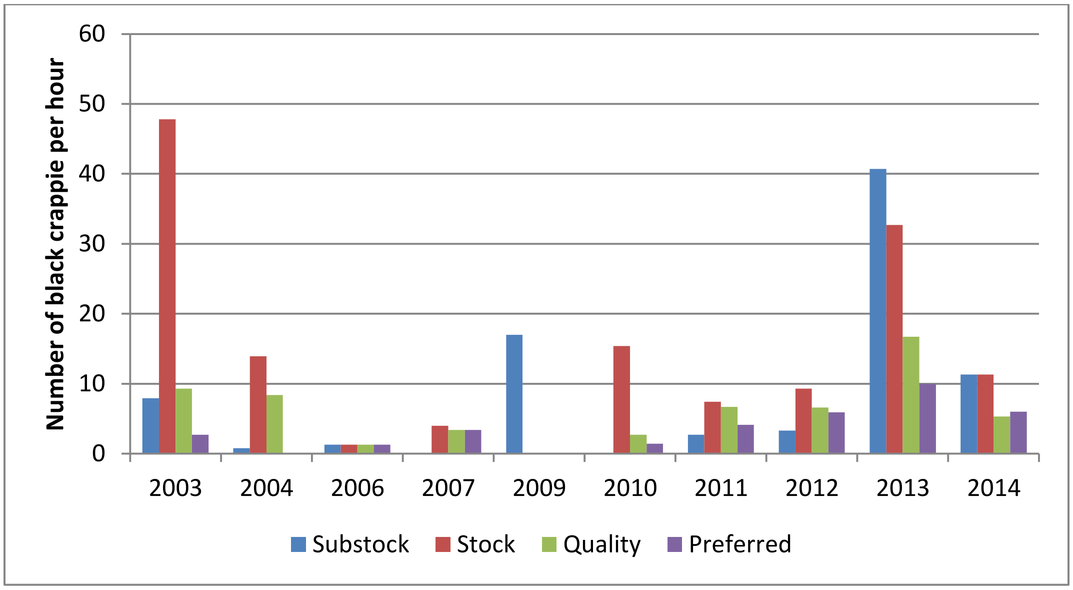

Figure 12. The CPUE for substock-, stock-, quality- and preferred-size black crappie collected from Henderson Lake, LA during fall electrofishing (2003-2014).

Size distribution for black crappie in 2014 is shown in Figure 13. The majority of fish collected were sub-stock (< 5 inches) with few fish from the quality (8-10 inch) or preferred size (10-12 inch) range.

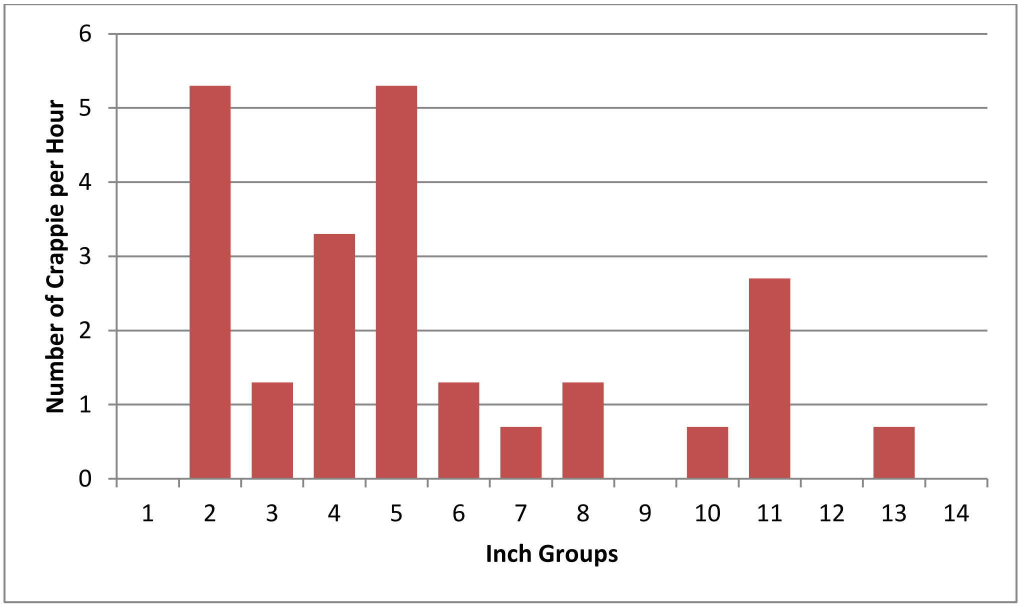

Figure 13. Size distribution for black crappie collected from one hour of electrofishing at Henderson Lake, LA in fall 2014 (n=34).

Sunfish

Shoreline seine sampling is conducted to collect information related to species composition, year class strength, and prey availability. Henderson Lake sampling was conducted in summertime periods of 2000, 2001, and 2005. All samples were conducted at night from one-half hour after sunset until one–half hour before sunrise. One quadrant haul, using a 25 foot x 6 foot seine, was conducted at each sampling station. A total of three samples were taken each year at three boat ramps, one per ramp. The quadrant haul was conducted by anchoring one end of the seine at the shoreline and the other stretched perpendicular to the shoreline. The distal end was then swept back around to the shoreline, keeping the lead line tight and on the bottom. After the seine haul is completed, all fish from the seine are placed in a plastic bag, properly marked, and placed on ice. Fish specimens were sorted to species, and by length. Total number of sunfish collected is provided in Table 3.

Table 3. Sunfish collected from Henderson Lake, LA by seine haul from 2000-2005.

YEAR	TOTAL NUMBER CAUGHT
2000	1,110
2001	738
2005	1,450

Commercial

Commercial landings statistics are reported by parish and not by waterbody. As a result, landings data specific to Henderson Lake is not available. However, Henderson Lake has a thriving commercial fishery. Harvest includes crawfish, catfish, buffalo, and freshwater drum.

Aquatic invasive species

Asian carp are present in Henderson Lake. They include the grass carp, common, bighead, and silver carp. Asian carp fish kills have been observed during periods of rapidly decreasing water level.

Creel Surveys

Angler creel surveys were conducted in 2000, 2001, and 2005. The survey method used was an access point survey of completed fishing trips. Percent of total harvest by species is presented in Table 4.

Table 4. The results of creel surveys conducted on Henderson Lake, LA, by year. Results are presented as the percent of total harvest of fish by species.

SPECIES	**2000**	**2001**	**2005**	**AVERAGE**
Bluegill	34.9%	55.0%	53.2%	45.5%
Black Crappie	25.9%	14.9%	25.2%	23.6%
White Crappie	23.0%	6.6%	5.7%	13.5%
Largemouth Bass	7.0%	3.7%	4.1%	5.3%
Warmouth	1.7%	2.2%	4.9%	3.0%
Redear Sunfish	1.7%	2.7%	2.9%	2.3%
Freshwater Drum	1.0%	8.1%	0.2%	2.0%

White Bass	0.5%	1.9%	0.7%	0.8%
Blue Catfish	0.1%	1.4%	1.1%	0.7%
Channel Catfish	0.4%	1.8%	0.2%	0.6%
Yellow Bullhead	0.2%	0.0%	1.3%	0.6%
Buffalo	1.3%	0.0%	0.0%	0.6%
Yellow Bass	0.4%	1.6%	0.0%	0.5%
Bowfin	0.6%	0.0%	0.4%	0.4%
Spotted Gar	0.8%	0.0%	0.0%	0.3%
Spotted Sunfish	0.1%	0.2%	0.2%	0.1%
Carp	0.2%	0.0%	0.0%	0.1%
Black Bullhead	0.1%	0.0%	0.0%	0.0%
Smallmouth Buffalo	0.0%	0.0%	0.0%	0.0%
Flathead Catfish	0.0%	0.0%	0.0%	0.0%

Another angler creel survey was recently conducted from July 1, 2013 through Dec. 31, 2014. The survey method used was an access point survey of completed fishing trips. The size distribution of angler harvested largemouth bass for the 18 month duration of the creel is presented in Figure 14. The majority of fish harvested were in the 13 and 14 inch groups. During this time period, it is estimated that 55,934 largemouth bass were caught. Of those, 15,428 were harvested and 40,506 were released, for a release rate of 72%.

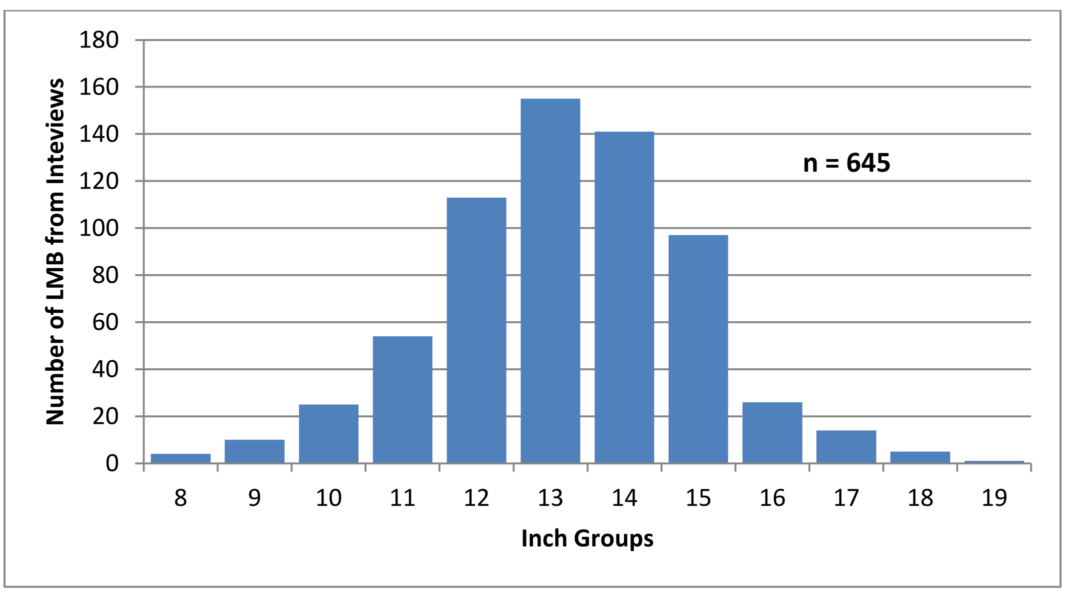

Figure 14. The size distribution (inch groups) of angler harvested largemouth bass from Henderson Lake, LA for July 1, 2013 – December 31, 2014.

HABITAT EVALUATION

Aquatic Vegetation

There is ongoing concern with overabundant aquatic vegetation in Henderson Lake. The primary species of concern are hydrilla (*Hydrilla verticillata*) and water hyacinth (*Eichhornia crassipes).* Complaints related to boating access are common from fishermen, hunters, camp owners, and boat launch operators. Unfortunately, immediate relief is typically expected. However, the chemical used to control water hyacinth is a systemic herbicide. Systemic herbicides are effective, but a few days to several weeks may be required for complete plant mortality. The effects of systemic herbicides are directly related to plant metabolism, which is related to air temperature. Private boat landings as well as the public launch at the I-10 Butte La Rose Welcome Center are often cleared of water hyacinth only to have rafts of new plants block the ramps following a change in wind direction. During the summer and fall of 2013 and 2014, there was approximately 50% coverage, or 2,500 acres of hydrilla in Henderson Lake as seen in Map 1 below. Presently, hydrilla coverage is unknown due to high water levels that persisted through the summer months of 2015. Other Plant coverage estimations made during the summer of 2013 and 2014 include approximately 30% coverage, or 1500 acres of water hyacinth, and around 100 acres of giant salvinia (2% coverage). Giant salvinia (*Salvinia molesta*) appears to be rapidly increasing within the lake, and may become one of the more problematic species of aquatic plants in the near future.

Giant salvinia was first detected in Henderson Lake in the fall of 2012. Though eradication efforts were made, plants were observed again in 2013. Biological treatments were applied in September 2013 with the release of plant material containing giant salvinia weevils (*Cyrtobagous salviniae*). An estimated 19,360 adult weevils were released at that time. Another release conducted in late July 2015, included an estimated 14,580 adult weevils.

During 2014, LDWF spray crews treated 2,215 acres of water hyacinth with 2,4-D, 63 acres of alligator weed with 2,4-D, 34 acres of common salvinia and 56 acres of giant salvinia with either a glyphosate/diquat mixture, or diquat depending on the time of year. During November 1st-March 31st, only diquat is used to spray salvinia species, while a glyphosate/diquat mixture is used from April 1st-October 31st based on the differences in plant metabolism and air temperatures. Also, 8 acres of pennywort were treated with 2,4-D. No contract spraying was necessary in 2014.

At the end of 2014, LDWF's Inland Fisheries Division began an attempt to downsize the aquatic plant program by ending temporary sprayer positions and focus more on private applicator contracts to treat problematic areas. This cost-savings effort removed 2 sprayers from the District 9 office that assisted in spraying efforts on Henderson Lake. Because of this, there will no longer be a dedicated LDWF spray crew on the lake. Vegetation management will instead be achieved through privately contracted treatments.

As of August 2015, 205 acres of water hyacinth had been treated with 2,4-D. No contact spraying has been necessary thus far.

Triploid grass carp (TGC) were stocked in 2014 (25,000 fish, 12+ inches in length) to assist with the ongoing hydrilla problem within the lake. The fish were certified as being triploid (sterile) by the U.S. Fish and Wildlife Service.

Map 1. Henderson Lake hydrilla coverage as of June, 2013.

CONDITION IMBALANCE / PROBLEM

1. In the absence of natural controls, invasive aquatic vegetation, including water hyacinth, giant salvinia, and hydrilla become overabundant each growing season.

2. Atchafalaya River water inundates Henderson Lake during high river flows. During a river flood pulse, water enters the control structure on the south end of the impoundment and then drains out of the same structure when the water later recedes. This hydrologic condition often creates a low dissolved oxygen situation and associated fish kills.

CORRECTIVE ACTION NEEDED

1. Reduce overabundant vegetation through available means of control. In 2013, LDWF met with officials from St. Martin Parish and the town of Henderson, LA and proposed a fall 2013 drawdown. All parties were in favor of the proposed action. Mr. Guy Cormier, St. Martin Parish President, applied for a drawdown permit with the USACE in the summer of 2013. This permit is required due to an Indian burial site that could be exposed with a reduction in water level. The permit was not issued because of the length of the permit process and a federal government shutdown (USACE, personal communication). The LDWF recommended a drawdown for the fall of 2014, and the St. Martin Parish Government re-applied for a permit. The permit was issued in August 2014 and is valid for 5 years. A drawdown was initiated in mid-August of 2014, and water levels were maintained at 6.0 ft. MSL until November 1st. Another drawdown is scheduled for the fall of 2015, but due to persistent high river levels throughout the summer, the drawdown will not be able to begin in August. LDWF will monitor problematic vegetation during the drawdown, evaluate its effectiveness, and make recommendations for future control efforts.

2. There are two solutions to the recurring fish kills in Henderson Lake.
   a. The first option would be for Henderson Lake to be completely separated from the Atchafalaya Basin and become a reservoir kept at pool stage with a structure that prohibits Atchafalaya flood waters from entering and draining from the southern end. The structure would need to be constructed with an overflow feature to allow rain water to drain from the lake and have the capability to conduct annual drawdowns for vegetation control.
   b. The second option would be to completely remove the control structure at the drain and have openings to the Atchafalaya River in the northern portion of the lake. This would allow Henderson Lake to fluctuate naturally with the river stage and have water flow from north to south through the system. The annual drying and flooding of Henderson Lake would then more closely mimic historical conditions.

RECOMMENDATIONS

1. Five consecutive years of summer/fall drawdowns beginning in 2014 are recommended for Henderson Lake. Previous efforts have proven that single year drawdowns have little effect on hydrilla in Henderson Lake. The southern control structure should be opened after the spring/summer flood cycle has fallen below 9 ft. MSL at the Butte La Rose gauge. The structure should remain open until the water level is 3 ft. below pool stage (6.0 ft. MSL). The dewatering rate should not exceed 4 inches per day. The 6.0 ft. MSL water level should be maintained as long as possible to achieve maximum potential. The heat from the summer months, as well as the possible freezing temps from the winter months, could provide a potential 'double impact' to vegetative propagules during a drawdown. After the first drawdown, as many as 80-90% of hydrilla tubers in the bottom sediment will sprout, giving the false impression of failure. Consecutive drawdowns will be necessary to deplete hydrilla propagules in Henderson Lake. Natural water level fluctuation in the Mississippi/Atchafalaya Rivers will re-flood the lake during the winter and early spring months.

2. EPA approved herbicides will be applied to nuisance aquatic weeds in accordance with LDWF Aquatic Herbicide Procedure. Water hyacinth will be controlled with 2,4-D (0.5 gal/acre) and a non-ionic surfactant (1 pint/acre). Both common salvinia and giant salvinia will be controlled with a mixture of glyphosate (0.75 gal/acre) and diquat (0.25 gal/acre) with Aqua King Plus (0.25 gal/acre) and Air Cover (12 oz./acre) surfactants from April 1 to October 31. Outside of that time frame, diquat (0.75 gal/acre) and a non-ionic surfactant (0.25 gal/acre) will be used. Sedge will be controlled with the aforementioned salvinia treatments if it is associated with those plants. If it is targeted specifically, 2,4-D will be used in conjunction with a non-ionic surfactant (1 pt./acre).

3. Standardized sampling will be conducted as per LDWF protocol.

4. Continue to work toward development of a comprehensive Henderson Lake Management Plan. Cooperative partners should include the St. Martin Parish Government, U.S. Fish & Wildlife Service, U.S. Army Corp of Engineers, LA Department of Natural Resources, U.S. Geological Survey, and LDWF.

5. Triploid grass carp retention will be monitored through LDWF standardized sampling. As a preliminary measure to reduce TGC escapement, an agreement with the St. Martin Parish government should be reached to limit control structure openings.

6. Continue to closely monitor and treat giant salvinia infestations as necessary. Giant salvinia weevil releases will continue on a routine basis.

REFERENCES

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.